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ABSTRACT

The document describes a process-oriented strategy for assessing children with atypical motor development. The Ordinal Scales of Psychological Development in Infancy by I. Uzgiris and J. Hunt are used as the content base. The intervention program focuses on teaching parents techniques for enhancing the child's functioning in sensorimotor, motor, and communication functioning. Unique features of the Uzgiris-Hunt instrument are noted, as is its conceptual basis. Adaptations of the instrument are described, including modifying the task or materials and carrying out the child's direction. Four levels of organization in sensorimotor intelligence are described and examples of adaptations for physically handicapped children are given: undifferentiated actions (systematic repetition of simple schemes); differentiated actions (intentional use of schemes within familiar contexts); regulation by differentiated feedback (discovery of new means to ends by new combination and modification of familiar schemes); and anticipation of regulations (problem solving through nonovert adaptation of multicomponent actions). Implications for parent instruction include a feedback model in which the child's developmental level determines the complexity of parental input, and the parent's input changes as the child's abilities change. (CL)

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Meyer Children's Rehabilitation Institute/University of Nebraska Medical Center

# A STRATEGY FOR ASSESSING MORTORICALLY-IMPAIRED INFANTS

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# A Strategy for Assessing Mortorically-Impaired Infants

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# A STRATEGY FOR ASSESSING MOTORICALLY-IMPAIRED INFANTS

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The assessment of cognitive development in children who demonstrate atypical patterns of motor development has presented a problem to all professionals involved in working with children who have motor handicaps. Some strategies for adapting tasks to the response mode available to the child have been developed. For example, Else Haeussermann's (1958) techniques for assessing developmental potential in preschool children are one such strategy. Her techniques emphasize adaption of the testing materials and mode of presentation to the child's current response repertoire. Moreover, her use of systematic variation of materials to permit identification of the basis of a child's response has been extremely valuable as a model for developing teaching approaches appropriate to a child's developmental level. We think Hauessermann's strategy should be extended to the assessment of cognitive functioning during the first two years of life. Therefore, we have used the Ordinal Scales of Psychological Development in Infancy, devised by Uzgiris and Hunt (1975) as the content base for developing the strategy of adapting assessment to the response abilities of young children who have impairments.

## Rationale for the Assessment Strategy

The term assessment is used here as a process distinct from testing. Assessment is used to evaluate strengths and deficits in order to provide a basis for intervention (Simeonsson, 1977). Additional products of an assessment, be it developmental or competency based, include not only evaluation of the skills already mastered by the individual but also his or her response to interventions designed to teach specific skills or tasks, and ability to perform given tasks in different settings and with different persons (Bourgeault, Harley, DuBose, and Langley, 1977; DuBose, Langley, Stass, 1977; Langley, 1978; Simeonsson, Huntington and Parse, 1980).

DuBose, Langley, and Stass (1977) identify the assumptions made in a process-oriented approach to assessment. Those assumptions include:

> (1) a view of the child as an "active agent" who operates on his or her own environment;
>
> (2) that the learning processes used by the individual child can be measured and modified within the context of a process oriented assessment;
>
> (3) that the child's learning potential is best assessed by observing performance in a task where corrective feedback is provided, i.e., a learning task (p.3)

A critical component to a process oriented approach to assessment of cognitive development in children with physical handicaps is consideration of the physical requirements of the task. Specifically the concern

is that a child may be judged to lack intelligence on the basis of testing with an instrument that includes tasks that are physically impossible for the child to perform. There are two aspects to the problem of assessment of children with physical disabilities. The first aspect is theoretical, i.e., whether actual physical manipulation of objects and the experience of voluntary movement and exploration of the environment are necessary experiences to accomplish the developmental tasks of the sensorimotor period. The issue has been addressed by Decarie (1969) in her studies of Thalidomide children and by Kopp and Shapermann (1973) in a clinical study of a child with congential amputation of both upper extremities. In both studies children with impaired means for manipulating objects or self-determined exploration of their environments demonstrated development of object permanence. Kagan (1970) has offered a view of infant cognitive development that aids in interpreting the findings of Decarie (1969) and Kopp and Shapermann (1973). Kagan suggests that children can develop perceptual and conceptual structures through observation, in the absence of actual manipulation of material.

While Kagan agrees that motor actions are important aids for certain kinds of learning, they are not essential for development of sensorimotor accomplishments such as object concept and causality. Kopp (1974) argued that Kagan's (1970) data as well as other data on learning abilities of the infant during the first several months have implications for techniques of appraisal and treatment of atypical children. She pointed out that "too many professionsals, for too long a period, have conceptualized intelligence, particularly for the young, mainly in terms of voluntary controlled motor movements: (p.7).

The second aspect of the issue is pertinent only if one accepts the

argument that there are alternatives to motor performance in sensorimotor problem solving situations that are acceptable as indices of a child's conceptual understanding. The second aspect, then, is what are acceptable, alternative indices that a child has certain sensorimotor schemes? Several investigators have used responses such as change in heart rate and visual searching in response to a violation of a sensorimotor principle such as object permanence (Bower, 1974; Zelazo, Hopkins, Jacobson, and Kagan, 1974) and have argued that such responses are sufficient evidence that the child has the concept of object permanence Fetters (1976) has demonstrated that when a visual searching response was used as an alternative to a given motor searching response, six of seven children with motor handicaps resulting from central nervous system dysfunction performed at a higher level of object permanence than when the traditional task requirements were set as the performance criterion.

Our efforts to develop alternative assessment strategies using the Uzgiris and Hunt (1975) Scales are described in this chapter. In contrast to my previous description of the development of this strategy (Robinson and Fieber, 1974: Robinson and Robinson, 1978), I have attempted here to organize our adaptations in relation to the four organizational levels of sensorimotor development proposed by Uzgiris (1976):

1. Level of simple undifferentiated actions comparable to Piaget's Substages II and III;
2. Level of differentiated actions comparable to Piaget's Substage IV;
3. Level of regulation by differentiated feedback comparable to Piaget's

Substage V;

4. Level of anticipating regulations comparable to Piaget's Substage VI.

Based upon additional experience in use of the Scales with children who have motor disabilites, I have found that different strategies of adaptation were appropriate at different substages. The organizational levels of sensorimotor development proposed by Uzgiris offer guidance to an analysis of why different strategies would be needed.

The intervention model in which the Uzgiris-Hunt Scales have been used with motorically impaired infants is one of parent-mediated intervention and will be described in the following section. Uzgiris and Hunt and their colleagues use of the Scales as a means of assessing the effect of diverse caretaking environments as well as Hunt's writing on the optimum discrepency hypothesis have influenced our approach to instructing parents. Implications of this use of the Scales for working with parents of handicapped infants will also be discussed in a subsequent section of this chapter.

## Infant Development Program

The Infant Development Program at the Meyer Children's Rehabilitation Institute, which is the context for the observations to be reported in this chapter, was initiated in 1973. Much of the original focus for the Infant Program was based upon the author's experience in the Toddler Research and Intervention Project (Bricker and Bricker, 1971, 1972, 1973). It was in the Toddler Project that some of the first work

with disabled children was done. The children in the Toddler Project were developmentally delayed although few had significant physical or sensory handicaps. In that context it was possible to use the Scales with a handicapped population without modifications.

Upon initiating the Infant Development Program at a center with staff who were specialists in treatment and management of children with cerebral palsy, the potential utility of the Ordinal Scales with physically handicapped children and the need for modifications in the administration of the Scales became apparent (Robinson and Fieber, 1974).

Population

The population seen in the Infant Development Program is quite heterogeneous, including children with retardation, vision and hearing handicaps, cerebral palsy, and other motor disabilities. About one third of the children seen have multiple handicapping conditions, frequently of a moderate to severe degree. Children range in age from a few months up to about two years of age at time of referral.

Program Approach

The approach that is used in the Infant Development Program is based upon several assumptions. These assumptions include:

(1) that intervention with young handicapped children should include instruction of an infant's parents in the rationale for and specific activities being used with their child;

(2) that instruction for parent and child be based upon a developmental model;

(3) that it is important that the child have opportunities

to actively participate in the program by being provided the opportunity to make choices appropriate for his or her development level;

(4) and that instruction should be based upon the premise that development is "integrated and organized" across behavioral domains (Stroufe, 1979).

There are two aspects of our rationale for teaching parents to work with their handicapped infants ; one aspect pertains to their role as parents and the other aspect to the nature of sensorimotor intelligence. With respect to the parents' role, it seems most useful to teach parents about the developmental course through which we anticipate their children will progress and the type of experiences that we expect will foster their progress. The approach of teaching parents child development information to aid them in parenting has been made available to many parents, not just those who have children with developmental disabilities. The term useful here refers not only to economy in use of professional resources but also practicality in use of child and parent time. So much of a child's day is typically spent with his or her parent that one wants those interactions to be guided by experiences of knowledge likely to facilitate development.

Once the decision has been made to intervene with handicapped infants by teaching their parents, the problem then becomes what to teach the parents. The second assumption in our approach is the use of a developmental model. Within the Infant Program, the content of parent instruction has two major components: (1) significant achievements in the various behavioral domains of sensorimotor, motor, and

communication functioning, and (2) the context in which those developments typically occur, that is, what types of interactions and materials seem to foster progress toward those developments. We tend to think of the latter area as teaching techniques; however, teaching is meant here not in didactic sense, but rather as emphasizing a style of interacting with the child that acknowledges the interplay between cognition and motivation (Uzgiris and Hunt, 1975). More details regarding this approach to parent instruction can be found in Rosenberg, Robinson and Bell (1978). Extensive description as to how sensorimotor content is conveyed to the parent can be found in Robinson and Robinson (1978).

The rationale for the third assumption, that children should actively participate in the intervention through choice making, follows from the ever increasing body of literature in which the infant's competencies and motivation to competence are emphasized (Hunt, 1965; Seligman, 1975; Watson, 1966; White, Kaban and Attanucci, 1977; Yarrow, 1979). When early intervention programs for handicapped infants were initiated, the emphasis was on doing things to stimulate the infant's senses, with little emphasis upon the child's response. Such an emphasis is antithetical to current understanding of infant development. However, with children who have moderate to severe physical or sensory impairments or delays, there is a tendency among professionals to intervene by doing things to such children, perhaps because the children do not have the same strategies that an unimpaired infant has for refusing such interventions. Thus, we attempt to guide our design of interventions with the following question: Will this activity give this child an opportunity to learn to exercise greater control over his or her physical or social environment (Robinson

and Robinson, 1978)?

The fourth assumption used to guide the design of parent and child instruction in the Infant Development Program is that development is "integrated and organized" across domains. There are at least two practical implications of this assumption. Instruction or therapy in any domain, such as language or motor development, is best provided when the therapist is aware of the child's developmental status in other domains of development and utilizes that information in selection of techniques for working on particular tasks. If sensorimotor development involves the hierarchical organization proposed by Uzgiris and Hunt (1975), then deficits and input of information, sensory or motor, will have implications for eventual integration and organization of information.

## Utility of Uzgiris-Hunt Scales in Infant Intervention

Uzgiris and Hunt (1975) describe several conceptual differences between their Scales and traditional scales of infant intelligence. Several of those differences are pertinent to the selection of these Scales for use in an intervention program for handicapped infants. The difference between the two types of scales and the implications of those differences for intervention to be discussed here include: (1) the meaning and measurement of individual differences, (2) the conceptual significance of individual items, and (3) the relationship among individual items on the scales.

The measurement of individual differences when using traditional scales is through comparison of an individual's rank in performance with a normative group (Uzgiris and Hunt, 1975). Such a comparison is

frequently utilized for the diagnosis of retardation or developmental delay. Once such a diagnosis is made, infant intelligence scales are generally of little value for prescriptive programming. This lack of value in part derives from the way in which the traditional scales are constructed. Uzgiris and Hunt (1975) point out that traditional scales are comprised of achievements that are grouped by age of co-occurrence with no inherent relationships assumed among items. The items tend to be simple, readily observable, motor actions not selected to signify changes in the child's ability to organize information. Traditional scales are designed from an additive view of progress with each item carrying equal weight in contribution to a total score. The Uzgiris-Hunt Scales were inspired by Piaget's writings and based upon an assumption of an hierarchial relationship among abilities and motive systems. Responses to specific eliciting situations are "landmarks of implied levels of achievement" (p. 16). Items were selected because of their presumed conceptual significance to planning of meaningful arrangements of circumstances that will promote development. Measurement of individual differences is meaningful as a basis for comparing the "development-fostering capacity of diverse child rearing regimes" (p. 16) by noting the age at which children with diverse experiences achieve specific landmarks.

The conceptual basis underlying these Scales is important because it provides a way to differentiate cognitive developments from the behaviors through which we typically infer their presence. An example may help here. Object permanence is classically inferred from a person's physical search for an object with which he has lost sight or in the case

of a blind person, with which he has lost sensory contact (either sound or touch). A physically handicapped, preverbal child may not be able to physically search for an object, but given an alternative mode of expression, that child might be able to indicate that he knows where the hidden object is located or, in the case of ambigious situations, indicate how to go about searching for the object. An alternative strategy for a verbal person would be to tell you where to look for the object. For a person who is not yet talking, the alternative may be to point to the location. Thus, the series of object permanence situations provides us with a definition of a concept, objects continue to exist, and the eliciting situations in the series provide us with a method for analyzing the extent of the child's understanding of the concept, that is, what are the bounds of his searching behavior in terms of length of time between disappearance and recovery, complexity of hiding situations, and the materials and their value to the child? Does he or she have the scheme at a generalized level? The emphasis upon a conceptual organization within the Scales provides us with a starting point for the identification of experiences that are related to development of the sensorimotor concepts and eventually to a formal system of communication. These characteristics of the Scales compared to traditional scales form the basis of our selection of them for use in the Infant Development Program.

An assessment instrument for any age rarely is unitary in terms of the behavioral domains involved in performance, but the assessment of infant intelligence is especially confounded in this regard. When infants are identified as having disabilities that are likely to interfere with normal developmental progress during the first 18 months of life,

their behavioral discrepancies when compared with a normative group are typically of such magnitude that there is little diffi ulty in identifying the child as handicapped. Thus, assessment of a motorically or sensory impaired infant for purposes of comparison to norms for children without such impairment or for purposes of prediction of a future status is inappropirate. However, an assessment to determine a child's response to specific interventions or to reflect a profile of strengths and weaknesses with respect to a conceptual model is appropriate.

An even more important characteristic of the Uzgiris-Hunt Scales with respect to design of interventions for motorically o- sensory impaired infants is the conceptual basis of the times and the assumption that development occurs through coordinations and differentiations among the sensorimotor series. This conceptual basis of the Scales is their most useful characteristic for application with physically impaired children. Many of the behaviors typically sampled in infant intelligence scales are behaviors that may never be possible for a child with severe physical involvement. Yet many infants with severe motor impairments when assessed during the preschool or school years give evidence of what some clinicians are willing to call normal intellectual potential. The question as to whether the typical sensory motor experiences of acting on the environment are necessary to development of operational intelligence or whether opportunities to observe the typical actions and view their consequences are an alternative route to development of operational intelligence is an important one that should be addressed. While we are waiting for an answer regarding the necessary and sufficient conditions for development of the highest level of sensorimotor concepts, we can use the conceptual guidance provided by an analysis

of the accomplishments of the sensorimotor period as a base for development of preoperational intelligence.

Uzgiris and Hunt (1975) suggest that there are four important learning sets that a child acquires during the sensorimotor period. Those learning sets are "(1) things should be recognizable, (2) if I act I can make things happen and I can find interesting things to do, (3) things have names, (4) things come in sets or classes" (p. 40). These four learning sets provide a framework for examining the content of both the eliciting situations and actions in the sensorimotor scales with respect to the behaviors, e.g., motor components of actions, which are coincidental versus those which are essential to expression of the sensorimotor learning sets. The example of alternative ways for assessing object permanence has already been given. Another example may be helpful. In assessing operational causality, the child is shown a spectacle such as a mechanical toy that is activated by winding a key; the most advanced action in this eliciting situation is for the child to attempt to find a way to activate the object prior to demonstration by the examiner. However, the child need not be successful in activating the toy in order to be credited at this level in the eliciting situation. Thus, the issue is not whether the child can activate a mechanical toy but whether she recognizes that the toy can be re-activated. This can be assessed by structuring the situation so that once the child indicates that she wants to see the spectacle again, the child is asked how to make it happen. A point or a touch to some part of the toy can be interpreted as an exploration, then the part that the child points to can be manipulated in some way by the examiner. If it is the correct mechanism, the spectacle will be repeated;

if it was incorrect, it will not. In either event, the child will get the feedback of the consequence of her direction. Since our goal is the elaboration of the learning set "if I act, I can make things happen" as a route to "things come in sets or classes," we have provided experience with an exemplar of the set or class "mechanical toys that can be activated."

## Organizational Levels

In developing strategies for modifying actions required of the child in sensorimotor situations so as to accommodate to the child's motor abilities, initially we used two basic strategies: (1) modifying the task or materials so that the child could perform the task, or (2) becoming the child's hands by carrying out his or her directions. Upon post hoc examination of those two strategies, it seems that one may be more appropriate than the other depending upon the child's sensorimotor level. An example may help clarify what is meant here. When we first utilized a directed look or a point as an alternative action to a physical search and recovery of the object (object permanence), we were working with children 18 months or more in chronological age, and given the alternative strategy, they were performing correctly in the more complex (Substages V and VI) search situations. When this strategy of being the child's hands after being told where to look was attempted with younger children who were in Substage IV, the children had to be taught to use the strategy of a directed look or reach. If they were Substage III, the strategy of teaching them to "play the game" did not work very well.

Also, with the benefit of hindsight, it is apparent that when working with a Substage III child, we tended to place greater emphasis

upon experiences that can be classified as examples of the learning set "if I act, I can make things happen," and in doing so, we placed greater emphasis on the strategy of modifying the situation so that the child could be successful within the range of his or her motor abilities. The rationale for such an emphasis comes from the recognition that the experience of making things happen is a potent reinforcer for the infant (Watson 1966; Yarrow, 1979). Therefore, now, for the Substage II child who is physically handicapped and not otherwise likely to experience this personal efficacy, we try to facilitate the experience of reproducing perceptual events. One strategy for facilitating this experience is to tie a piece of yarn to the child's wrist and the other end to a toy such as a wind chime that will make noise and move while suspended over the child's crib. For the Stage III child who is physically handicapped and has impaired reach and grasp, we might tie a block on the end of a piece of string to be used as a tool in order to make the tool easier for the child to grasp (Robinson and Fieber, 1974; Robinson and Robinson, 1978).

Uzgiris (1976), in a discussion of the organization of sensorimotor intelligence, proposes four organizational levels "with the intent of facilitating a formal analysis of the various tasks used to assess sensorimotor functioning" (p. 159). She further suggests that the purpose of the analysis is to examine the diverse sensorimotor tasks to determine whether they possess a "formal similarity" or "structure." To reiterate, the levels of organization that she offers are: (1) level of simple undifferentiated actions (Piaget's sensorimotor Substages II and III); (2) level of differentiated actions (Substage IV);(3) level of regulating differentiated feedback (Substage V); (4) level of anticipating regulations (Substage VI)

(pp. 149-160). This framework has utility for developing hypotheses about the interactions among sensorimotor content, e.g., object permanence, imitation, causality, etc., sensorimotor organizational level and appropriate strategies for modifying the indices for criterial performance for a given eliciting situation. In an effort to make the relationship between the levels of sensorimotor development and the strategies for adapting tasks more graphic, a table which includes the sensorimotor accomplishments and specific examples of task adaptations will be provided for each of the four organization levels.

Level I: Simple Undifferentiated Actions

In working with handicapped infants who are functioning at less than six months developmentally (Substage II or early Substage III), the sensorimotor content that we have tended to emphasize comes from the Means-Ends, Causality, and Schemes scales. The learning set emphasized at this level across these content areas is "if I act, I make interesting things happen." If the child's movements are severely limited, e.g., if there is little voluntary movement of the limbs, then we try to facilitate these experiences by providing the parent with demonstrations as to how to "rig" the environment (Robinson and Robinson, 1978). In designing such "riggings," ideally we try to design different consequences for different simple schemes. For example, waving an arm will produce one sound and a foot kick will produce a different sound. Brinker (1981) as part of the Early Childhood Institute at The Educational Testing Service, is currently developing a procedure utilizing the Apple II computer which will permit him to look at the responses of delayed infants to such differentiated

consequences. The fact that infants less than six months of age can learn such differentiations has been demonstrated (Watson, 1966; Watson and Ramey, 1977). A generalized level of such a response has received several different labels in addition to the learning set "if I act, I can make interesting things happen and I can find interesting things," including "contingency awareness" (Watson, 1966) and "generalized expectancy awareness" (Lewis and Goldberg, 1969). The importance of such experiences to the development of "contingency awareness" and the importance of an expectancy of personal effectiveness has been proposed by Seligman (1975) as a necessary condition to the prevention of "learned helplessness" (Robinson and Robinson, 1978).

Closely aligned to the Substages II and III Means-End eliciting situations are the Substages II and III eliciting situations for Causality. In these eliciting situations, one observes the child's reaction to a familiar game situation and his or her behavior to a spectacle created which can be interpreted as a request, or signal, for the game or event to occur again. This is typically a very positive area to emphasize in instruction to the parent for several reasons, one being that even with a very severely physically involved child, the parents and child have typically evolved some sort of games that they play (Walker and Kershman, 1981); thus, we are able to point out something positive that the child does that makes him or her more similar to other babies. Second, this is an area of development that many investigators are relating to language development in that the reciprocity involved in interaction games seems to be a basis for learning rules of dialogue (Stern, 1974; Bruner, 1975) and the use of procedures as requests for events to occur again (Snyder, 1978;

Sugarmann-Bell, 1979). With some planning, many of the day to day interactions between the infant and adult can be made into experiences that expand the child's opportunities to exercise control over his environment and expand the "if I act...." learning set (Robinson and Robinson, 1978). Tables 1 and 2 are designed to illustrate this strategy. Table 1 contains an analysis of a physically handicapped infant's actions in day to day situations as expressive communication at the organizational level of simple undifferentiated actions. Table 2 shows an analysis of the same child's actions with respect to the assumed meaning for the child. This type of analysis is used as a framework for directing parent-child and teacher-child interactions so as to maximize the opportunities to give the motorically impaired child "control" over his or her environment through communication.

Insert Tables 1 and 2 here

The strategies suggested to be most useful during this period include attention to the position of the child, the position of materials and the selection of materials, all with the goal of facilitating the child's opportunities for active responding. It is suggested that at this level, the child needs the actual feedback to his or her activity. Observing an event happen as a function of someone else's action, for the means-ends situation or without a request in the case of the causality situation, will probably not suffice. Level I accomplishments and illustrations of their adaptations for physically impaired children are presented in Table 3.

Insert Table 3 here

## Level II Differentiated Actions

The next organization level proposed by Uzgiris corresponds to sensorimotor Substage IV and is the level of differentiated actions.

Uzgiris (1976) concludes the description of this level by saying: "Thus, while outcomes do regulate actions, the regulation is global, leading to a reconstruction of the whole action sequence rather than modification of a component of the sequence. In novel problem situations, the attainment of a solution through gradual approximation or through the observation of demonstrated solutions does not seem to take place" (p. 154). During this period, the child is beginning to differentiate means from ends and repeats successful combinations of schemes; however, he or she is dependent upon a highly familiar context for doing so, and the combinations of schemes are not at all flexible. The observation that the child does not seem to benefit from demonstration of solutions appears to be the critical point in the consideration of selection of alternative response strategies. Again, the strategies that involve modifying the task requirements to facilitate the child's action seem to be the most promising. The strategy of being the child's hands for him or her may be less useful perhaps because the child does not yet appear to benefit from demonstrated solutions. However, one might ask if being the child's hands for him or her shouldn't work because you ask him or her to signal for an event before you carry it out? Examination of the parallel developments during this substage may help here. During Substage IV, the child begins to differentiate use of schemes across different objects, searches for a hidden object in one of two locations, uses strings as intermediaries, reproduces a mechanical toy's action through direct action on the toy, and begins functional use of very familiar objects. In terms of communication development, the child is beginning to recognize names, game words and some commands with situational cues; he or she will signal his wants with complex schemes, but they will be either

object or person directed, i.e., signalling a person to remove a cover from something requires a novel combination of schemes that is not characteristic of this organizational level of sensorimotor or communication behaviors (Harding and Golinkoff, 1979).

During this period, it may be possible to begin to teach the child to play a game of "tell me where it is hidden," or "tell me how to make this go again," or " do you want to do this again." In order to teach such games, it will be necessary to have a great deal of similarity from one opportunity to the next and a good number of contextual cues which serve the function of telling the child that this is the situation in which this works. There is another feature of sensorimotor development that seems especially pertinent to this and subsequent organizational levels. In their introduction to the Scales, Uzgiris and Hunt (1975) point out that they were looking for situations that would help to explicate the interplay between cognition and motivation. This interplay is quite evident in descriptions of the young infant's response to making mobiles turn or wind chimes move or using procedures to make adults repeat games. The delight with the discovery of "I made it happen" extends beyond sensorimotor Substages II and III and is a source of motivation that is frequently neglected with children with physical handicaps. It can be painful to watch a child struggle to move a short distance and then pick up an object. A frequent tendency is to "help" the child by bringing the object to him or her. Such "help" is appropriate if the person already knows he or she can do it himself or herself and the "help" is a matter of convenience. The Substage IV sensorimotor child may not yet know that he or she can do it for himself or herself and until he or she does, doing things for him or her does not help. Here again the logic

points to assisting the child in active responding by altering the materials, the position of the child, and the position of the materials. The accomplishments and strategies for adapting tasks for the Level II child are presented in Table 4.

Insert Table 4 here

Level III Regulation by Differentiated Feedback

The next level proposed by Uzgiris (1976) is the level of "regulation by differentiated feedback," corresponding to sensorimotor Substage V. In discussing this level, she suggests that the commonality among the diverse achievements in object permanence, causality, imitation, etc. at this level is that "the appearance of regulating relationships between outcomes and actions (with compensation and correction of successive actions) seems to be the main advance in structional organization" (p. 156). Thus, at this level the child can combine familiar actions in ways which are novel for him or her. Also, the child is imitating new responses and associates those responses to objects in culturally approved ways. So his or her schemes appear to be modified not only by their direct outcome but also by social feedback to the use of a particular scheme with a particular object. Developments in communication during this period include: use of words or gestures as labels of objects or events when the objects or events are present; responses to pictures as signifiers of familiar objects; coordination of schemes first applied to objects and then persons as requests.

At this level, we find we can use the strategy of being the child's hands for him either through coactive movement (Fieber, Personal Communication) or by asking the child to indicate through signal, gesture, or

Word what we are to do next. The coactive movement strategy, which involves placing oneself behind the child and physically assisting the child's movement by prompts or by placing one's hands over the child's hands and waiting for him to indicate intent and then assisting him in that action, carries the advantage of giving the child the experience of "doing it" himself with assistance. While doing it for him may make something happen more quickly, it cannot be said too often the negative effect such doing for a child has upon the child's motivation to do something or interact with something in the future.

The sensorimotor accomplishments and task adaptations for the Level III child are shown in Table 5.

Insert Table 5 here

Level IV Anticipating Regulations

The final sensorimotor organizational level proposed by Uzgiris (1976) is that of "anticipating regulations." This level corresponds to sensorimotor Substage VI, and the accomplishments of the child during this stage are often cited as the bridge between the practical intelligence of infancy and representative intelligence of early childhood (Uzgiris, 1976). Uzgiris suggests that "the coordination achieved between the construction of multicomponent actions and the regulation of action sequences by their outcomes at this level allows for a non-overt adaption of actions, or in other words, thought" (p. 158). The specific sensorimotor achievements noted during this period include systematic search for an object the precise location of which is unknown, foresightful solutions to problems, activation of mechanical toys, and imitation of invisible movements, novel words and phrases. With respect to communication, achievements include

understanding of and use of labels for objects in their absence, combination of words into phrases and coordination of person and object schemes, e.g., taking a person to a location where an action is to be performed. This use of words or gestures in the absence of the object or person seems to be a critical component to a full elaboration of the use of our strategy of being the child's hands for him at his direction. Ability to call upon previous experience and solutions is, of course, a very important tool for the child. In using the alternative strategy, we must keep in mind that this is only an emerging ability for the child and one which will be greatly elaborated over the coming months and years. While it is emerging, the child may well continue to need contextual cues and supports for his or her solutions to problems. For example, when faced with the problem of retrieving something out of reach, the child without motor involvement may bring a stool from another location to the place where he or she needs the added height, climbing on the counter to get the cookie jar being the classic example. If one tried to get this child to describe before going to get the stool what he or she is going after, even though he or she may recognize the name for the object, it is likely that he or she will not be able to produce the label. Thus, the availability of the solution and the label for the item needed for the solution are different tasks. The child with physical impairment involving arms and hands and locomotion is also likely to have impaired oral motor funcitons, so we are not likely to be able to ask him what someone needs to do to solve the problem. He or she may, however, with systematic instruction in a structured situation be able to select from two to three objects what is needed for the solution, and with experience utilizing such a strategy, he or she is likely to be able to put elements of a

solution into sequence using the same strategy of pointing. Any elaborate sequencing is likely to be at the preoperational level. It is obvious that the form of this solution is different from the form of the solution for the ambulatory child. What is not yet known is whether the effects the two solutions have upon the child's ability to organize future information are equivalent. In the absence of an answer to that question, we are proceeding with trying to arrange experiences and opportunities to test out solutions to problems based on the premise that the function that a solution serves is more important than the form of the solution itself. The sensorimotor accomplishments and adaptations for tasks for the Level IV child are presented in Table 6.

Insert Table 6 here

Cautionary Notes

It has been pointed out to me (Fieber, Personal Communication) that some professionals who have attempted to utilize the Scales in work with children who have handicaps have viewed the series as criterion referenced assessments. In this regard, the eliciting situations have been used as though they were items on a checklist. Landmarks were then treated as criteria to be accomplished and once accomplished, the assumption was made that the child was ready to move on to the next step. There is some value in using the Scales as a conceptual guide to a child's typical accomplishments during the sensorimotor period. The organization into the several ordinal series provides a basis for analyzing the tasks involved in each series into component tasks. Such an analysis also served as our initial basis for looking at motor components to tasks in terms of whether they appeared to be coincidental or essential to the structure being

assessed (Robinson and Fieber, 1974). However, there are some dangers in viewing the series as criterion referenced checklists. One such danger is placing greater emphasis upon the form of the behavior than the function that that behavior serves. The value of the Scales, it has been pointed out, lies in their conceptual base. The sensorimotor content and organizational levels serve as a basis for designing alternative responses that are indications of the same cognitive accomplishment. This point tends to be overlooked if the situations are viewed simply as items on a scale. A second danger in viewing the scales as items rather than eliciting situations is that frequently too little emphasis is placed upon looking for evidence that the child has mastered the structure being assessed at a generalized, or learning set, level. Use of the landmark behavior across situations should be the criterion for assuming the child is ready to move on to the next step. It is to guard against this problem--not assessing for generalization--that the organizational levels proposed by Uzgiris may be especially helpful.

The organizational levels place an emphasis upon unifying landmarks across series according to the changes in the structure of intelligence that each level reflects. In this context, each landmark becomes somewhat less important as a criterion and more important as one of the numerous signifiers of a change in level of functioning. A third danger is a tendency to view each of the steps in a scale as behaviors that must be in the child's repertoire for advancement to the next level rather than recognizing them as typical responses to eliciting situations that are dependent upon a number of factors in addition to the child's

physical ability to perform the task. These factors include environmental (both social and physical) factors as well as the child's motivation and prior experiences. The fourth danger is a tendency to lose sight of the emphasis which Uzgiris and Hunt (1975) placed upon the interplay between the child's motivation and performance on cognitive tasks. This danger occurs when the eliciting situations are interpreted as standardized instructions which must be rigidly followed rather than using them as guides for selection of activities that might be of interest to a given child.

Another cautionary consideration to the use of the Scales concerns the nature of handicaps that are likely to occur in physically handicapped infants. Typically the most obvious problem in young handicapped children is their physical involvement. As we see more handicapped infants at increasingly earlier ages, it is becoming apparent that many of these infants have sensory impairments as well. These sensory impairments may be integrally related to the child's primary condition or may be a consequence of problems created by that condition. In either case, we need to continually consider the possibility that the child's sensory mechanism or perception of input may be atypical. Also, we need to consider the possibility that the combined effects of such impairments upon opportunities for learning and organization of experience may be synergistic rather than merely additive. The knowledge of multiple disabilities when they occur is, of course, essential to meaningful assessment and intervention with an infant.

## Implications for Parent Instruction

The authors of the Scales and others have used the Scales as a means of assessing the effects of diverse caretaking environments upon the age at which children display specific landmark behaviors (Hunt, Paraskevopoulos, Schickedanz, and Uzgiris, 1975; Wachs, 1976). We feel that in addition to utilizing the content of the Scales as a basis for designing interventions for handicapped infants, the Scales have potential utility for use as a way of assessing specific aspects of a caretaking environment for the handicapped infant (Rosenberg and Robinson, 1980). The rationale for this use of the Scales comes from Hunt's writings about the importance of experiences being matched to the child's developmental level. Underlying current research on parent-infant interaction is the idea that the way in which parents interact with their children affects the growth of those children. Specifically, it is possible that infants develop more rapidly when the environment presents them with experiences that are adjusted to their level of development (Hunt, 1961; Hunt and Paraskevopoulos, 1980; Stern, 1974; Wachs, 1977).

The assumption that development is enhanced when a match is achieved between the child's developmental level and input to the child implies a particular model of parent-child interaction. This is a feedback model in which the infant's developmental status regulates the complexity of parent behavior toward the infant, and in turn, parental input influences the infant and the infant's rate of developmental progress. There are two key ideas here. The first is that parental input must be compatible with the capacities of the child, challenging the child sufficiently to increase learning without either frustrating the child by being too complex or boring the child by being too simple. This requires that the child provide cues

to allow the parent to judge whether compatibility has been achieved. Therefore, the second idea is that the child should respond to compatibility with interest and pleasure, giving the parent easily identifiable effective evidence of a match. This feedback model then is, in a sense, a wedding between the optimum discrepancy hypothesis (Hunt, 1961; McCall and McGhee, 1977; Wachs, 1977) and the competence motivation hypothesis (White, 1959), resulting in a focus on cognitive input to the infant regulated by affective feedback to the parent (Birns & Golden, 1972; Sroufe, 1979). In this model, the child's developmental level determines the complexity of parental input, and the parent's input changes as the child's abilities change.

During the past decade there has been a proliferation of programs which aim to enhance child development by modifying parent behavior toward the child. Several programs have been demonstrated to be successful with handicapped and at-risk children when success is measured by increases in the child's rate of developmental progress (Baker and Heifetz, 1976; Bronfenbrenner, 1975; Radin, 1972; Shearer and Shearer, 1976). Why should this be? The matching model may be able to provide an explanation of the success of these "indirect" interventions with children as well as a framework within which to predict whether an untried program is likely to work. Let us examine for a moment the logic of an education program designed for the parents of handicapped or developmentally disabled children. In order to reach the conclusion that parents should be the target of an intervention even though helping children is the goal, one must assume first that the parent is a primary source of developmentally relevant input and second, that this source is not doing as

good a job as it could in providing input that is appropriate and beneficial. These are exactly the kinds of assumptions that would be made in the matching model. Therefore, it might be profitable to try to use the model to determine where to look for the source of the apparent breakdown in the efficacy of parental input to developmentally disabled children.

In terms of the model, a breakdown could potentially occur in four places: (1) The parent's assessment of the child's developmental level - the parent of a handicapped child may not be as aware of what the child can and cannot do as would the parent of a normally developing child; (2) The parent's manner of presentation of input after an assessment of level - the parent of a handicapped child may not have a teaching strategy that is appropriate to the needs of the child; (3) The parent's utilization of feedback cues from the child -the parent of a handicapped child may not get enough information from the child to know whether or not the input is appropriate, compatible,and pleasing. This could happen because the developmentally disabled child is not as effective in the production of cues as the normally developing child and/or because the parent is not sensitive to the cues the child does produce;(4) The parent's decision to increase the complexity of input to the child - the parent of a handicapped child may not be able to judge when the child has mastered a given level of sensorimotor complexity and needs to move on to a higher level.

So far parent education programs appear to have concentrated more on the manner of presentation of material used by the parent than on any of the other potential sources of breakdown. There is a good reason for

this: disabilities with infants are associated with disturbed patterns of parent-infant interactions. For example, Jones (1977) has found that pre-linguistic Down's Syndrome infants invite less feedback from their mothers through eye contact and provide fewer opportunities for parents to respond to their vocalizations than do normal infants. Handicapped children also seem to learn differently than normally developing children and require different kinds of teaching-learning interactions (Cheseldine & McConkey, 1979; Field, 1978). Normally developing infants appear to profit most when they are given access to a variety of manipulable objects plus the freedom to choose what they explore. For these children, the optimal teaching strategy is to provide input that encourages activity but does not determine the task that is selected (White, 1972). However, developmentally disabled infants appear to require substantially more structure, coaching, and praise in order to engage in and maintain learning activity (Filler, 1974; Smith, Filler, Robinson, Vincent, and Bricker, 1973). If left to their own devices, many slowly developing infants will perseverate on developmentally primitive activities. They tend to seek less stimulation than they require and become apathetic, resulting in further growth retardation (Hunt, 1976). The handicapped infant may be less likely to initiate play with objects or persons in his or her environment than the typical child. One consequence of less initiation or long delays before initiating play activities may be that the parent has fewer cues to which he or she can react in efforts to encourage more complex play. For these reasons, parent education programs have attempted to modify the more reactive style, i.e., waiting for the child to initiate an activity, toward

which many parents are naturally inclined by instructing parents in techniques of Applied behavior Analysis and Precision Teaching. Thus, an important dimension along which parent education programs differ is the extent to which they attempt to instill a directive, parent-driven approach to parent-infant interaction in order to overcome the learning problems of the handicapped child.

Despite the great value of focusing on a teaching style appropriate for both parent and infant, the matching model indicates that there are several characteristics of parent-infant interactions that are important for making such interactions maximally effective. As we have indicated, there are at least three other places we might look for deficiencies in parent-infant interactions. If the matching model is correct, then we would make a serious mistake if we did not vigorously pursue all four potential sources of developmentally inappropriate parent-child interaction, or mismatching. Therefore, our project sets itself two goals along these lines. The first is to evaluate the matching capacities of parent-infant dyads that include a developmentally disabled infant. Since parent education programs seem to be based on the assumption that parents match activities less well to their handicapped children than to normal children, we ought to find out if that is true, and if so, in what way. The second is to use the information so obtained to lay the groundwork for a comprehensive evaluation of parent education techniques. If the matching model is correct, then parent education programs should be evaluated directly with respect to their impact on the matching capacities of parent-infant dyads. It is entirely possible, for example, that programs could inadvertently disrupt reciprocal matching capacities

in the course of changing the parent's teaching style from reactive to directive. The more parent-driven the style of interaction sought by the program, the more likely this possibility. That particular outcome could be unfortunate , indeed, since the parent would gain a teaching method but perhaps lose the capacity to interpret the child's cues as to what is interesting to him or her. The seriousness of this risk is highlighted by Cheseldine and McConkey's (1979) finding that language acquisition in Down's Syndrome infants is enhanced when their parents model the desired behavior using non-directive statements rather than attempting to directly elicit the response through questions or demands. Similarly, Field (1977) reports that maternal-child interactions can be made to deteriorate by having mothers actively attempt to sustain eye contact with the infant rather than allowing the infant to set the pace of en face regard. Without a systematic test of the matching model and a specific adaptation of the model to handicapped infants and their parents, we cannot assess the extent of the trade-offs between increased directiveness and decreased matching skills. As a part of investigating the matching model then, we wish to find out whether differences exist in the matching capacities of dyads with normal versus developmentally handicapped infants, and we wish to find out what happens to the matching capacities of dyads as parents become increasingly directive in their teaching style.

## Summary

In this chapter I have described the manner in which we have utilized the Ordinal Scales in an intervention program for children with neuromotor handicaps. There have been two major foci to our use of the Scales in this context. The first has been to use the Scales as a content base for assessing cognitive level in handicapped infants and toddlers. I have argued that the purposes of the Scales and the manner in which they were constructed makes them especially appropriate for evaluating physically handicapped children. In developing this strategy of adapting criterion responses to take the child's disability into account the organizational levels of sensorimotor development proposed by Uzgiris (1976) have been useful. The second focus for use of the Scales described in this chapter is in relationship to Hunts "problem of the match." Rosenberg and Robinson (1980) have preliminary data which suggest that the content and the stages represented in the scales can be used to classify mother and child responses and analyse those behaviors in terms of degree of correspondence of sensorimotor level and complexity.

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TABLE 1

Analysis of Child's Actions as Expressive Communication

| | Eliciting Situation | Child's Behavior | Meaning to Adult | Adult Response |
|---|---|---|---|---|
| 1. | Child has been in chair for considerable length of time. | Fusses and goes into extension. | He wants out of the chair. | Says "Do you want out?" |
| | Child is asked do you want out? Touch cue to sides of trunk is given at same time. | Arm movement and hand movement. | He means yes he wants out. | Says "You told me you wanted out". |
| 2. | Child is lying on back on floor. Teacher has been through motion of pat-a-cake game. Teacher pauses and says "more?" and touches the child's hand. | Child gives eye contact to teacher, smiles and moves hands to teachers hands. | He wants to play pat-a-cake again. | Starts pat-a-cake verse. |
| 3. | Action of See 'N Say is shown to child, the teacher then says "more?" | Child hits at See 'N Say. | He wants me to activate it again. | Activates the See 'N Say and says "you want it again?" |
| 4. | Child is placed on back or exercise ball and bounced gently. Mom pauses, says "more?" and gives a movement cue of moving the ball slightly. | Child kicks,<br>Kicks and smiles,<br>Smiles and vocalizes,<br>Makes eye contact. | He wants to bounce again. | Says "let's bounce" and bounces child again. |
| 5. | Child is placed on tummy on exercise ball, Mom begins to roll ball. | Child fusses. | He doesn't like this. | Says "Oh you don't like this". |
| | Mom takes child's hands forward, establishes eye contact and sings familiar song "See Saw". | Child stops fussing, smiles and lifts head slightly. | This way is okay, he feels secure now. | Says "this is better isn't it?" |

TABLE 2

Analysis of Child's Actions as Indicators of Understanding Adult's Communications

| | Events | Child's Response | Assumed Meaning to Child | Available Cues by Sensory Modes |
|---|---|---|---|---|
| 1. | Child is positioned on pillow, turned to his right side. | Anticipatory excitement indicated by generalized movement, smiles, moves arm. | Going to have something to hit at | Feel of familiar position, sight of familiar place, person. |
| 2. | Child is placed on pillow and given verbal cue "roll" and touch cue to hips, mom is in sight at side where child is to roll. | Initiates roll movements and therapist assists to complete. | Wants me to roll to side. | Auditory "roll<br>Handling "touch"<br>Visual "mom"<br>Familiar game. |
| 3. | Child is in chair, Baby Food jar is on table, child does not typically eat during therapy session. | Generalized excitement, movement, smile, vocalizing. | I'm going to eat. | Visual, recognition,<br>Auditory, none<br>Sequence, none. |
| 4. | Child is on mat and given verbal cue "Bounce, want to bounce?" | Eye contact, no recognition. | No apparent meaning. | Verbal cue only apparent cue. |
| | Child is then shown big ball and asked "want to bounce, bounce"? | Anticipatory excitement, indicated by generalized movement, smiles. | I'm going to bounce on the ball. | Visual - sight of ball<br>Auditory - "bounce-bounce". |
| 5. | Situation for rolling game. Mom is positioned to one side, favored toy to other. Child in on pillow. | Looks to mom, laughs, initiates roll and completes roll to left. | Going to play ball game. | Visual - position of mom and toy,<br>Touch - feel of pillow,<br>Sequence - first thing done in session. |
| 6. | Adults say "Pat-a-Cake?" and claps hands together twice. | Looks expectant and smiles. | Going to play. | Vision, sees hand motion<br>Auditory - "Pat-a-cake". |

TABLE 3

Level 1: Simple Differentiated Actions

| Sensorimotor Accomplishments | Strategies for Adaption of Tasks |
|---|---|
| General: Systematic repetition of simple schemes. | General: Facilitate active responding through position of materials, child, etc. |
| 1. Object Permanence<br>Child searches for partially covered object. | Interpret child looking at partially covered object as an "I want it" signal and uncover and give it to child. If he swats at cover, help him remove it. |
| 2. Means Ends<br>a. repeats movements systematically, producing spectacles. | Rearrange environment so child's simple motor schemes will be as effective as possible. String from wind chime to child wrist. Try to arrange environment so that in different situations one response can have different consequences. In crib, foot kicks activate wind chime. In bounce seat, foot kicks make chair bounce. |
| b. Moves directly to an object or pulls support, obtains object. | Use an easily grasped support, fasten object to support so it will not fall off. Physically assist the child into the pulling if he will permit it. |
| 3. Causality<br>Cessation of adult caused spectacle elicits schemes toward adult or object. | No adaptation necessary, accept whatever child does as a procedure; analyze and interpret responses as illustrated in Table 1. |
| 4. Schemes<br>a. Simple object schemes<br>b. Begins complex object schemes | Adaptations will be primarily in terms of using objects that child can grasp and activate. |

TABLE 4

Level 2: Differentiated Actions

| Sensorimotor Accomplishments | Strategies for Adaptation of Tasks |
|---|---|
| General: Schemes are used together intentionally but use is dependent upon familiar context. | General: Modify task requirements to facilitate active responding. |
| 1. Object Permanence<br>a. Searches for object hidden under one screen. | Place child in position that favors active responding, side lying etc. Use easily removed cover. Place a cover over a well so object doesn't move if cover is pulled away quickly or with uneven motion. Begin to teach game "tell me where to look" by interpreting his or her looking at the location of the object as an indication of where it is. |
| b. Searches for object hidden under one of two screens. | Same strategies as in previous example but by now child should be willing to play game of"tell me where to look" by looking at the location in a very familiar context. |
| 2. Means Ends<br>Use tool, such as string or cloth, to obtain an object. | Facilitate responding by using some thing which will serve as a handle to end of string, use easily grasped tools. |
| 3. Causality<br>Indicates with object or person directed scheme that he wants something to happen again, e.g., Pushes hand toward object. | No adaptation necessary, accept the child's schemes as communicating wants. |
| 4. Schemes<br>Demonstrates functional use of objects. | Show child familiar object which has everyday use,e.g., cup, spoon; observe for movements that suggest recognition, e.g., open mouth, smack lips, etc. If child does not show something interpretable as recognition immediately, demonstrate function, observe for recognition. Record change over time in number of cues necessary for recognition. If child reacts with a procedure simply on sight of object, he is probably functioning at next level of organization. |

TABLE 5

Level 3: Regulation by Differentiated Feedback

| Sensorimotor Accomplishments | Strategies for Adaptation of Tasks |
|---|---|
| General: Discovers new means to ends by new combination of familiar schemes and modification of schemes during the problem solving process. | General: Being hands for child either with coactive movement or by carrying out his directions. |
| 1. Object Permanence<br>Child searches for object when exact location is unknown, i.e., invisible displacements. | Hide object, ask child to tell you where to look; he may do this by pointing with hand or eyes. If child points to incorrect location, show him, "not there, where else should I look?" |
| 2. Means Ends<br>Child uses unattached tool to obtain object. | Stage a situation where a tool is needed, have tool in view. Ask child to tell you how to get object by pointing to tool, try to use whatever child points to. Dramatize actions to create more interest. |
| 3. Causality<br>Child attempts to activate mechanical toy after demonstration. | Demonstrate action of mechanical toy. After cessation, ask child "how do we make it go again?" Accept a touch to the mechanism. If child will tolerate it, perform action with him, using physical guidance. |
| 4. Schemes<br>Represents functional use of objects and shares interaction with object. | Show child object with everyday use. Ask "what do we do with this?" Note if child does something which can be interpreted as recognition of the function. If child does not recognize it on sight, add additional cues, i.e., demonstrate function. |

TABLE 6

Level IV: Anticipating Regulations

| Sensorimotor Accomplishments | Strategies for Adaptations of Tasks |
|---|---|
| General: Solves problems through nonovert adaptation of multicomponent actions. | General: Though presenting problems in a meaningful context request the child to provide direction to the solution, through words or gestures. |
| 1. Object Permanence<br>Child searches systematically for hidden object when location may be one of several places. | Stage hiding, ask child where to look, be his hands for him. Follow his directions, correct or incorrect, give feedback appropriate to the direction. Incorrect- "No not this"; correct - "that's right." |
| 2. Means Ends<br>Demonstrates foresightful behaviors in problem solving situation. | Stage a problem such as a cookie jar out of reach. If child does not spontaneously point to tools such as a stool, ask leading questions, carry out the actions according to the child's directions, providing a running commentary as you do so. |
| 3. Causality<br>Exploration of ways to activate mechanical toys. | Strategy is the same as for means ends problems at this level. |
| 4. Schemes<br>Child engages in representational play at a simple level, simple being chains of several actions but not a highly elaborated script. | Again you need to be the child's hands but offer choices. "Will the doll eat a cookie or drink her juice next. Who does the pouring today? Oh, the rabbit puppet. We have no pitcher. Is there anything we can use for a pitcher?" Include the latter to determine whether the child can begin to substitute one object for another. |